Claims

1. A plasma assisted reactor for the simultaneous removal of nitrogen oxides and carbonaceous combustion products from exhaust gases, comprising a reactor chamber (11) adapted to be connected into a gas exhaust system, a gas permeable bed of an active material (12) contained within the reactor (11), means (7, 13, 14, 6, 8) for causing exhaust gases to pass through the bed of active material (12), and means (6, 9, 10, 14, 5) for exciting into a plasma state exhaust gases passing through the bed of active material (12), characterised in that the bed of active material (12) includes a mixed metal oxide material having the general formula $A_{2-x}A^1_xB_{1-y}B^1_yO_4$.

2. A plasma assisted reactor as claimed in claim 1 for the simultaneous removal of nitrogen oxides and carbonaceous combustion products from internal combustion engine exhaust gases, further characterised in that the reactor chamber (1) is adapted to be connected into the exhaust system of an internal combustion engine.

3. A reactor according to claim 2 characterised in that the components A A^1 of the mixed metal oxide material are selected from the group of elements comprising La, Sr, Ba and K and the components B B^1 of the mixed metal oxide material are selected from the group of elements comprising Co, Mn, Cr, Cu, Mg and V.

4. A reactor according to claim 3 characterised in that the mixed metal oxide is La_2CuO_4.

5. A reactor according to claim 3 characterised in that the mixed metal oxide active material 12 is selected from the group comprising $La_{1.8}Ba_{0.2}CuO_4$; $La_{1.7}Sr_{0.3}Cu_{0.9}V_{0.1}O_4$; $La_{1.9}K_{0.1}Cu_{0.7}Cr_{0.3}O_4$; $La_{1.8}Ba_{0.2}Cr_{0.7}V_{0.3}O_4$ and $La_{1.9}K_{0.1}Cu_{0.95}V_{0.05}O_4$.

6. A reactor according to claim 4 characterised in that the mixed metal oxide is $La_{1.9}K_{0.1}Cu_{0.95}V_{0.05}O_4$.

7. A reactor according to any of claims 2 to 6 characterised in that the bed (1) of active material is in the form of an agglomeration of bodies (12) of the active material in the form of spheres, regularly or irregularly shaped pellets or hollow extrudates.

8. A reactor according to claim 7 characterised in that the bodies (12) of active material include a ceramic binder material.

9. A reactor according to claim 8 wherein the ceramic binder material comprises silica, titania or alumina or any combination thereof.

10. A reactor according to claim 8 or claim 9 wherein the ceramic binder material is present in the proportion of about three weight per cent.

11. A reactor according to any of claims 8 to 10 wherein the bodies (12) of active material are in the form of spheres.

12. A reactor according to any preceding claim characterised in that the means (5, 6, 9, 10, 14) for exciting the exhaust gases into the plasma state is separate from the bed (11) of mixed metal oxide active material (12) and precedes the bed (11) of active mixed metal oxide material (12).

13. A reactor according to any of claims 1 to 11 characterised in that the means for exciting the gases to the plasma state comprises at least two electrodes (6, 14) in contact with the bed (11) of active material and means (9, 10) for applying to the electrode a potential difference sufficient to excite the exhaust gases to a plasma state in the interstices of the bed (11) of active material.

14. A reactor according to claim 13 further characterised in that a dielectric barrier is provided between the said two electrodes (6,14).

15. A reactor according to claim 14 further characterised in that the dielectric barrier is provided in the form of a coating on the surface of one or both of the said two electrodes (6, 14).

16. A reactor according to claim 13, further characterised in that a material of high dielectric permittivity is incorporated in the bed of active material.

17. A reactor according to any of claims 1 to 12 characterised in that the bed of active material (12) is in the form of a gas permeable monolith.